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NOTES ON THE BIONOMICS OF THE MILKWEED BEETLE *TETRAOPES TETROPTHALMUS* (FORST.) (CERAMBYCIDAE) *

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There are several controversial questions in the literature pertaining to the life history of the milkweed beetle, *Tetraopes tetrophthalmus*. I made an attempt to find the solution to some of these questions during the fall of 1939 and spring and summer of 1940. The results of this study are offered herewith. The milkweed hosts of this insect were abundant along railroads near Urbana, and it was largely in such situations that these investigations were carried out.

Season of Adults. Because of the long cool spring of 1940, the adults of *Tetraopes tetrophthalmus* emerged from their pupal cells in the ground a few days later than usual in the vicinity of Urbana, Illinois. Records from the collection of the Department of Entomology at the University of Illinois show that they have been found in Urbana as early as June 6, and in many years were abundant by the second week in June. However, in 1940 the first adults reported from this locality were collected on June 17. By June 25 they were present abundantly. On August 1 there was a marked decrease in number, and from then on the population gradually dwindled until the last individual was seen on August 21.

Feeding. In this section of the country the adult feeds most frequently upon the common milkweed, *Asclepias syriaca* L., the swamp milkweed, *A. incarnata* L., and the thin-leaved milkweed, *A. perennis* Walt. Two milkweeds which the insect never seems to approach, even if they grow in a large patch of the more frequented Asclepiaceae, are *A. Meadii* Torr. and the butterfly weed, *A. tuberosa* L.

The adult beetle first feeds upon the smaller, younger more tender leaves at the upper extremity of the plants. Feeding at the tip of a blade, it eats an oval hole a quarter to three-quarters of an inch from the end of the leaf. Frequently it may devour all the leaf tissue to the end of the blade, leaving a large U-shaped gouge at the extremity. The flower buds are fed upon as they begin to appear, and finally the flowers themselves are attacked. In eating a flower a beetle frequently leaves nothing but the empty calyx, and sometimes the latter also is consumed.

Time of Mating. For a period of twenty days, beginning July 10, a record was kept of the number of individuals mating or *in situ* and the number of solitary individuals. An average of 200 individuals per day were seen over this period of time. It was found that the ratio of paired individuals to solitary individuals was between 1 to 1.2 and 1 to 1.5 on average sunny days. On cool, cloudy days or early in the morning before the sun was very high, the ratio was between 1.54 to 1 and 1.78 to 1. On exceedingly hot sunny days when the temperature was above 95°F., the ratio was between 1 to 2.2 and 1 to 3.7. This indicates that mating is much more prevalent during darker, cooler periods, while on hot sunny days the number of paired individuals drops off and there are more solitary individuals.

Oviposition. Chittenden (Weiss and Dickerson, 1921) found that females in captivity deposited eggs loosely upon the leaves of milkweed. Weiss

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and Dickerson (1921) were unable to draw any conclusions from their observations as to where the eggs are deposited, but it seemed probable to them that they might be placed at the base of the plant close to the main stem. Clench (1923) found that the beetles oviposited in the stems of half-weakened plants of *A. syriaca*, in a wire cage. However, he seemed unable to find eggs in stems in nature. I examined several hundred stems in the field but found no indications that there had been any attempt on the part of the females to deposit eggs within them. A cage with an oil cloth bottom was constructed out of doors over three individual plants of *A. syriaca*. Twenty-five pairs of *Tetraopes*, collected while mating, were placed within it. At the end of three weeks some of them were found dead. The dead females were dissected and found to be gravid. The plant stems showed no indication that the beetles had attempted to gnaw holes in them.

Gravid females were found within a few days after their emergence. Because I could find no indications that eggs had been deposited in the stems, I eventually concluded that the beetles might have been depositing their eggs all summer in the ground around the base of the plants. This led to immediate investigation. The roots of milkweed plants were examined, and on August 1, several larvae were found. The stems of these plants were split open, and the lower portion of each was found to be hollow, which is a natural condition, with the exception of the nodes which were still completely intact. Craighead (Clench, 1923) expresses the belief that the larvae may make their way down to the roots through the hollow portions of the stem, eating their way through the nodes. The discovery of larvae about the roots of plants which still had their nodes intact offers definite proof that the larvae do not bore down through the stem, but reach the roots in some other manner.

Sex Ratio and Oviposition. *Tetraopes tetraphthalmus* may have a sex ratio of 1 to 1. If this is not true it would seem logical to assume, judging from the frequency of copulation, that the males would be in the minority. However, it was found that of the beetles not copulating or *in situ* there were 34 per cent fewer females than males. A possible explanation for this may be that not all females were counted because they were in the tall grass around the roots of milkweed plants depositing their eggs.

Daily Turnover. In an effort to determine the turnover in a given milkweed patch, all beetles from a plot of 230 weeds were collected at three different times, brought to the laboratory and marked, then returned to the weed patch. The results of this experiment showed that there was nearly a 100 percent daily turnover of adult beetles in this patch of weeds.

Season of Larvae. Weiss and Dickerson (1921) found larvae in New Jersey on July 31. I found larvae on August 1 which varied greatly in size. This indicated that they were present a considerable time before this date. Just how long any one individual remains in this stage is not known, but it approaches ten months.

Larval Habits. The larvae feed upon the roots of *Asclepias syriaca*, *A. perennis*, *Apocynum cannabinum* L. (Indian Hemp), and possibly *Asclepias incarnata*. The root system of *A. perennis* is fascicled, while that of *A. syriaca* is a single horizontal creeping root. The roots of the first plant are all too small for the larvae to enter, while the root of the latter is sufficiently large for the larvae to burrow through. One-fourth of the larvae which I found associated with *A. syriaca* were actually boring through the centre of the roots.

Before the approach of winter the larvae construct a dirt cell which is apparently lined with a secretion. The cell keeps excess amounts of water from coming in contact with the larvae, and also protects the immature stages from the ravages of fungi, nematodes, and mites which readily attack the exposed insects.

Season and Duration of Pupal Stage. The first pupa was found on May 28 in a cell similar to the larval cell and probably the same one. This pupa was placed out of doors in a glass vial with a moist cotton plug inserted in the end. It was very difficult to tell when the adult actually emerged from the pupal skin. On June 12 the integument had become so thin that setae were visible in detail. On June 13, the pupal skin broke at the tip of the mandibles. From that time on, the old integument fell off in pieces. This individual remained in the pupal stage about three weeks. Under normal conditions in the soil, I presume this stage would last several days longer because the soil temperature is cooler than the air temperature at which this pupa developed. The last pupa was found on June 26.

SUMMARY

1. There is one generation a year.
2. The adult beetles were found from June 17 to August 21, and in greatest abundance during July.
3. The adults feed upon the leaves, buds, and flowers of *Asclepias incarnata*, *syriaca*, and *A. perennis*.
4. The larvae do not reach the roots of the above mentioned plants by eating through the stem.
5. The beetles do not oviposit in the stems of the plants but possibly in or on the ground around the base of the milkweed plants.
6. The larvae, which can be found before the end of July, construct dirt cells in which to overwinter and pupate.
7. When the dirt cells are broken or destroyed the larvae or pupae are subjected to attacks by fungi, nematodes, and mites.
8. The pupal stage has a duration of at least three and probably about four weeks.

BIBLIOGRAPHY

- Clench, W. J. 1923. Observations on the Oviposition of *Tetraopes tetrophthalmus* (Forst.) Papers, Mich. Acad. Sci., Vol. 3, pp. 367-368.
- Weiss, H. B. and Dickerson, H. L. 1921. Notes on Milkweed Insects in New Jersey. Journ. N. Y.

THE CLIMATE OF THE MARITIME PROVINCES

By D. F. Putnam, Canadian Geographical Journal, vol. 21, no. 3, pp. 134-147. September, 1940.

This is a summary of climatic conditions in the Maritime Provinces based on all available records. It discusses concisely, but quite fully, all the important climatic factors with the assistance of twenty-seven maps. Finally, the area is divided into ten climatic regions, the characteristics of which are described. Hytherographs are given for different regional climates.

This is a valuable paper from many points of view and the preparation of similar summaries for the whole of Canada would be very useful to entomologists and all workers in applied biology. It would seem desirable to have such summaries brought together under one cover.

R. E. Balch.

NOTES ON THE EFFECT OF DROUTH UPON THE NESTING HABITS OF ANTS

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The drouth in the prairie states and Canadian provinces in the early years of the 1930's had a marked effect upon ants which seems not to have been noted. My notes on this are very brief but are perhaps worth putting on record because of the apparent passing of this phase of a meteorological cycle.

On a one-day hundred mile survey of the adjoining southern corners of Manitoba and Saskatchewan in Canada and neighboring North Dakota, on July 15, 1934, particular attention was paid to the distribution of the common red ants, *Myrmica* spp., and the conspicuous thatching ant, *Formica rufa obscuripes* Forel. The day was warm and sunny. The area covered was in the midst of the long drouth and had suffered badly. Farms were being abandoned, and the sparse green vegetation was being eaten by hordes of grasshoppers. Severe dust storms had been sweeping the country intermittently. The itinerary and observations on these and other ants follow below.

Close to Upham (McHenry County), N. D., search was made of a dusty and thin patch of wolfberry, *Symphoricarpos occidentalis* Hook, near a dying poplar windbreak on an abandoned farm. After much searching, a single worker *Myrmica lobicornis praticornis* Emery and several workers of *Monomorium minutum minimum* Mayr, *Formica* (*Proformica*) *neogagates* Emery and *Lasius niger neoniger* Emery were found. There was no sign of ants on the surrounding prairie, which contained chiefly Russian thistle, a few other weeds, and very little grass. No thatching ants were found in situations where ordinarily they would be present. Grasshoppers and wasps were common.

Near Kramer (Bottineau County), N. D., a colony of the thatching ant was finally discovered under and at the sides of boards from the ruins of a farmhouse. The colony was small but aggressive. The boards doubtless served to conserve moisture in the soil about the ant chambers.

Two miles west of Pierson, Manitoba, and four miles east of the Saskatchewan boundary, a comparatively huge colony of *Myrmica brevinodis* Emery was found in the shallow ditch on the north side of the Canadian Pacific Railway embankment. Over an area in the ditch of fully 100 square meters (about 46 meters long by 1 to 3 meters wide), subdivisions of the colony were examined under scores of stones. Many stones were imbedded to a variable extent; others were lying on the surface. Under most of these were to be found chambers of the *Myrmicas* in soil, which was dry but less dry than the soil of the open prairie. Under many stones, roots of grasses extended, and on these were pastured aphids (*Trifidaphis phaseoli* (Pass.); det. P. W. Mason). When the stones were overturned, the ants carried off many of the aphids; other ants tried ineffectually to sting my hands. Underground tunnels connected the chambers under separate stones so as to make one polydomous nest. This colony amounted to probably 100,000 workers, or to that order of magnitude. No colony of *Myrmicas* with a comparable number seems to be recorded from any part of the world. One thousand workers constitutes a large colony of this genus under normal circumstances anywhere.

When live workers, brood, and aphids were collected from under a number of stones and taken in a container, they survived the trip back. For days the ants mingled freely in an observation nest and collected the brood and aphids into a single pile. They were fed disabled grasshoppers which they attacked and ate greedily.

At Gainsborough, Saskatchewan, a colony of *Myrmica lobicornis praticornis* Emery containing males was found in chambers in moist loam and gravel three meters from a stagnant pool in a creek bed. The chambers extended into

the soil to a depth of 15 cm. A colony of the thatching ant was found at the base of a fence post in the schoolhouse yard. The nest appeared normal and was probably protected by buildings from the fierce drying winds.

A mile west of Gainsborough a colony of *Myrmica brevinodis* was found in the same kind of habitat as was the preceeding *brevinodis* colony, the shallow north ditch of the railway embankment. The ants were nesting under a pile of stones surrounding the stump of a pole. In the chambers were males, some of which were callow, brood, and aphids (*Anuraphis* sp.; det. P. W. Mason). The latter were pastured on the roots and bases of grass stems, the bases appearing eroded from the gnawing of the ants or piercing by the aphids. Three miles north of Elmore, Saskatchewan, the customs station north of Sherwood (Renville County) N. D., two colonies of *Myrmica brevinodis* and colonies of *Tapinoma sessile* Say and *Lasius niger neoniger* were found, all nesting under rocks on the dry soil.

A mile south of Sherwood on sandy prairie with scattered bushes which resembled desert in lack of moisture and vegetation, a thatching ant nest was found. The nest was about 20 cm. high and typical in shape, being a flattened cone of grass and herb stems. It was, however, atypical internally because of the large amount of sand and clay filling the interstices of the upper layer. The soil had been blown into the nest by the terrific dust storms so common during these drouth years. Photographs of this nest in section have appeared in print. (Weber, '35).

SUMMARY

The effects of the drouth cycle of the early 1930's on the nesting habits of ants in the adjacent southern corners of Manitoba and Saskatchewan and neighboring North Dakota, as noted on a one-day survey, were as follows:

The common thatching ant (*Formica rufa obscuripes*) was absent from areas in which it ordinarily would be found. The only colony in one area was found nesting under loose boards on the prairie instead of under a conical pile of thatch which the ant usually forms. A thatch nest on the prairie was filled with wind-blown sand. A normal nest was seen at the base of a fencepost of a schoolhouse in the protection of a village.

A common red ant (*Myrmica brevinodis*) which often nests in moist areas was confined in two localities to the ditch beside a railway embankment, where more moisture, though little enough, was present in the soil than on the surrounding dusty prairie. Colonies had apparently coalesced to form a single huge, polydomous colony under stones consisting probably of the order of magnitude of 100,000 workers, an unprecedentedly large number. The stones were connected by underground runways. On roots of grasses beneath the stones, aphids (*Trifidaphis phaseoli* and *Anuraphis* sp.) were pastured by the ants.

Another common red ant (*Myrmica lobicornis praticornis*) was found nesting only in moist loam at the side of a nearly dry creek bed. Other common ants, *Tapinoma sessile* and *Lasius niger neoniger* were found nesting only under stones and were absent from areas in which they usually would be expected.

The nesting of ants under stones in depressions, or under stones and boards on the prairie, seemed here a clear adaptation to conditions of violent dust storms and drouth. Nest entrances normally exposed on the prairie would be filled up by wind-blown soil and the entire colony subject to dessication.

The years of drouth probably reduced the numbers of ant colonies on the open prairie considerably. While some colonies may have found more favorable sites, many colonies probably ceased to exist.

LITERATURE CITED

- Weber, N. A. 1935. The biology of the thatching ant, *Formica rufa obscuripes* Forel, in North Dakota. *Ecol. Monographs* 5:165-206, Figs. 5 and 6.

NOTES ON NEARCTIC TABANINAE (DIPTERA), PART II. *TABANUS* S. LAT. AND *HYBOMITRA*.BY CORNELIUS B. PHILIP,
Hamilton, Montana

The *gilanus* group and *T. sequax* Will. are elements obviously divergent from *T. bovinus* L., genotype of *Tabanus s. str.*, but which are provisionally retained in the genus *s. lat.* for reasons stated previously (Philip, 1941). The three following new species (one from northwestern Mexico) are related to the *gilanus* group.

***Tabanus abditus* n. sp.**

A medium-sized blackish species of much the gross appearance of dark *H. tetricus* or *T. fairchildi*, with three rows of abdominal triangles underlain by pinkish tints laterally, the wings entirely hyaline and without spurs at the bases of R₄, the palpi and antennae very stout, the latter entirely black. No ocelligerous tubercle. The male is unknown.

Holotype ♀, 15 mm. Head rather flattened across the top, the outer eye margins somewhat produced; the eyes black, unbanded (relaxed), with almost imperceptible scattering hairs. The front slightly divergent above, in height about four and one-half times its basal width, gray pollinose, with short black hairs especially at the vertex, no ocelligerous tubercle although the pollen is a little thinner; the median and basal calli almost blackish, barely joined, the former elliptical, almost half the width of the front mesally, the latter subquadrate, touching the eye margins below and rather convex. Subcallus yellowish pollinose, no hairs laterally as in *fairchildi*. Face and cheeks grayish to whitish pollinose and pilose. Antennae entirely black except some gray pollen on lower surface of the scape, the latter very swollen, taller than the third segment and extending like a hood over the second as in *erythraeus* and much more marked than in *pruinosis*, plate of the third segment very wide, its width subequal to the length and that of the annuli, but little excised dorsally, the dorsal angle subrectangular. Palpi very robust, the apical segment creamy, its length but little more than twice its thickness, strongly acuminate, covered with white hairs, a few black ones apically.

Thorax black with the usual gray lines pronounced, scutellum blackish with gray margins, prescutal lobes yellow, which color extends onto the pleurae, the chest gray; vestiture blackish above, intermixed with sparse, appressed, reddish hairs; white below. Coxae and femora blackish, gray pollinose and white pilose, except blackish on the upper surface of the fore femora. Tibiae reddish, darker apically including the apical half of the fore tibiae, predominantly white haired, including the hind-tibial fringe. Tarsi dark brown. Vestiture of subepaulets black, of tegulae yellowish, Halteres dark, yellowish on the outer half of the knobs (in *pruinosis* only the apical seams are pale).

Abdomen blackish above and below, the posterior and lateral segmental margins narrowly gray merging into reddish shades which extend forward on the sides of the second tergite in particular. The mesal gray triangles are rather narrow and entirely cross only the fourth and fifth tergites, the lateral triangles are in the form of diagonal dashes resting on the hind margins; venter predominantly white haired, with sparse black hairs beginning on the third sternite and increasing caudally.

Oak Creek Canyon, Arizona, June 9, 1940, G. E. Bohart. In the California Academy of Sciences (No. 5147), through courtesy of Dr. T. H. G. Aitken.

Two paratypes with same data in the collections of Dr. Aitken and the author. These are in essential agreement, except the basal callosities of the fronts are more brown than black, and being somewhat rubbed, the abdominal patterns are not as plain.

These were first thought to be small *pruinosis* Bigot, but the robust, black antennae, lateral abdominal dashes rather than spots, and lack of midventral dark band, in addition to size, exclude that species. It would run to *fairchildi* in Stone's (1938) key, but the first and third antennal segments are even more robust and the lateral hairs on the subcalli are lacking. From both species, the unbanded eyes (when relaxed) differentiate it. This is not the first interesting new form furnished by the isolated Oak Creek Canyon, hence the name. *T. hyalinipennis* Hine (= *dorsifer* Wlk.) also came from there originally but is smaller, more generally reddish including the scutellum, and the abdominal pattern is quite different with its absence of the mesal triangle on tergite 2 and those on 3 and 4 much broader and less tall.

***Tabanus oldroydi* n. sp.**

A pallid, chunky species related to the *gilanus* group, with laterally produced sparsely pubescent eyes, no ocelligerous tubercle, completely hyaline wings, and three rows of extensive, pale spots on the abdomen.

Holotype ♀, 14.5 mm. Head wide, eyes plainly pubescent; front buff pollinose, sides subparallel, slightly widened in the middle, a rather large, denuded yellow spot just below the vertex, but no raised tubercle, median callus broad, elliptical, yellowish, separated from the basal callosity which is slightly broader than high, does not quite touch the eye margins and has the upper corners acutely produced above; subcallus flat, pale yellow pollinose, the mesal suture continued upward across both basal and median callosities. Face and cheeks whitish pilose and pollinose, a few black hairs along the orbital margins on either side of the subcallus. Antennae pale red, black distad of the dorsal angle of the flagellum, rather slender, moderately excavated dorsally, the plate a little longer than the annuli. Palpi yellowish, entirely white pilose, the apical segment little swollen and markedly elongated and attenuated apically. Proboscis rather long, over half the height of the head.

Dorsum of thorax sparsely pilose with erect gray and appressed rufous hairs, the cinereous integument showing through, the lines indistinct, scutellum concolorous. Prescutal lobes reddish with mostly white, a few black, hairs. Pleurae yellowish, cinereous below; vestiture entirely white, extending onto the coxae and femora. Legs concolorous reddish, a few scattered black hairs on the fore femora and all tibiae, the fore pair a little darkened distally. Hind tibial fringe with mixed black and white hairs, darker apically. Veins yellow, no spur, cell R_5 widely open; tegulae with white and subcapaulets with sparse black hairs. Halteres pale brownish, yellowish on the knobs.

Abdomen broad, sides but little tapered, bluntly rounded on last three segments, coarsely hirsute on which depends the peculiar pattern (and which wear might almost obliterate), yellow on the lighter, blackish on the darker, paired maculations; predominantly dull, flesh red, a series of reddish brown paired spots mesally and sublateral abbreviated dashes basally on each tergite from 2 to 5, the mesal pair on only the second, appearing to be joined anteriorly by reason of a dull, underlying, anterior, cinereous spot in the integument. The paired spots subparallel in the anterior half of each segment, giving the appearance of a narrow middorsal stripe, but these spots suddenly bending transversely making the sublateral, pale, diagonal dashes the mesal reclining of any in the group. Venter uniformly yellowish pollinose and pilose.

Allotype ♂, 12 mm. Much less robust than the females, and of the same general color except hairs of the abdomen entirely yellow, the pattern of the female not indicated here except for indefinite darker integumental shadows in the middle of tergites 2 to 4, widening anteriorly to include the base of tergite 1. Second palpal segment elongate, bluntly rounded apically, length about

twice its thickness. Head proportionately among the smallest of the group by reason of the slightly differentiated upper eye facets, densely pubescent. Vertical tubercle very small, even with the upper eye level, brown pollinose and pilose, except for a minute forward pointed shining brown spot which might indicate a vestigial anterior ocellus. Fore tarsal claws subequal.

The types and two paratype females from Guayamas, Mexico, April 25 to May 21, 1928, Jose Gonzales. One paratype in collection of the British Museum of Natural History.

The eye pattern (relaxed) consists of two narrow purple stripes on a green ground, a third abbreviated one above in the females.

The species runs to *orbicallus* Philip in Stone's (1938) key to both sexes, but the more robust, broader build, and paler, more diagonal abdominal markings, the paired dark maculation more reduced and lighter in color readily distinguish the female from *orbicallus*. The male of the latter has a more distinct pattern on the abdomen. It is a pleasure to name this in honor of Mr. H. Oldroyd of the British Museum, who has been unsparing of his time in providing the writer with invaluable information of the Tabanidae in his charge. It may possibly be found within the United States in the vicinity of Yuma, Arizona, by collecting in the spring.

Tabanus intensivus Townsend. This has been misdetermined, by authors following Hine (1904), as the species *T. stonei* described below. The types of this and *T. gilanus* had become misplaced and were only recently located in part by Mr. Oldroyd in the British Museum. Both types of *intensivus* are present, ("W. F. Gila, N. M.", 7-10 and 7-13) concerning which Oldroyd writes: "after cleaning, *intensivus* is revealed as undoubted *dorsifer* Walker, with which (from type) *sexvittatus* Bigot is quite correctly synonymized." I have a compared specimen.

Tabanus gilanus Townsend. Only one type remains "in very bad condition . . . eyes destroyed (but face and frons intact), and only the first . . ." and parts of the next two abdominal segments remaining. The locality labels are the same as on the preceding types, with the date "7-10". I have a homotype compared with the fragments. For its separation, see discussion of the following species.

***Tabanus stonei* n. sp.**

Medium sized, grayish horesflies with three rows of pale spots on the abdomen, usually angular and crossing the segments, the sublateral ones consisting of rhomboidal dashes, the median ones of triangles open at the apices; the heads wider than the thoraces, and somewhat produced outwardly, eyes hairy with two green bands on a purple ground; without ocelligerous tubercles in the females or bare vertical tubercles in the males. Palpi stout. Infrequently the pale abdominal maculations are rounded, isolated from the segmental margins in the dark subspecies *jellisoni*, described below.

Holotype ♀, 13 mm. Front slightly convergent below, basal width is to height as 1:3.25, grayish pollinose, darker at vertex and either side the black median callus, latter subovate, separated from basal callus which is subquadrate, deep brown, strongly convex and touching the eye margins on either side. Subcallus thinly pollinose over yellowish integument, moderately convex. First two antennal segments dull reddish gray, the first not enlarged, the second with the usual dorsal process, vestiture black above, white below; third segment elongate, relatively slender, the dorso-basal angle low, rounded, excision shallow, predominantly black, brownish on the basal fourth (length, excluding annuli, is to width as 3:2). Face, cheeks, and palpi whitish, with white hairs, a few black ones intermixed on the front of the second palpal joint; last rather strongly swollen basally but acuminate apically, ratio 9:25.

Thorax gray with the usual dark dorsal stripes and yellowish prescutal lobes, vestiture on the dorsum consisting of erect black and recumbent yellowish hairs, some whitish hairs around the margins, extending over the entire pleural and ventral surfaces, coxae, femora, basal half of the anterior, and all but the extreme apices of the mid and hind tibiae; hind-tibial fringe white except for a few black hairs at the extreme tip. Femora blackish, gray pruinose, proximal half and most of the mid and hind tibiae yellowish. Wings hyaline, venation normal. Halteres smoky.

Abdomen rather broad, abruptly rounded posteriorly, the dark maculations consisting of three rows of rather narrow diagonal dashes practically crossing the tergites, a pinkish suffusion involving the sides of the first four; black and white, appressed hairs corresponding to the dark and pale pattern. Venter pinkish, with pale hairs and some black at the extreme tip.

Ten mi. E. of Three Forks, Jefferson Co., Mont., July 9, 1926, C. B. Philip.

Allotype ♂, 13.5 mm. Head wider than thorax, outer eye margins extended, upper eye facets moderately enlarged. Vertical tubercle gray pollinose, slightly raised above upper eye level. Frontal triangle gray pollinose, with a dark subshiny band across the apex. Cheeks and face whitish pollinose and pilose. Antennae with first two segments grayish pollinose, with black hairs above and pale below; third segment narrow, excision more pronounced than in the female, predominantly black, reddish basad of the dorsal angle and a little more below. Palpi creamy, white haired and not over a half dozen black hairs apically, second joint swollen, not quite twice as long as thick, rounded apically. Body pattern and vestiture essentially as in the holotype, but the pinkish cast to the sides and venter of the abdomen lacking, and the vestiture of the thoracic dorsum predominantly long and whitish. Hind-tibial fringe practically entirely white.

Bountiful, Utah, 6-25-29, H. J. Park, through courtesy of Dr. G. F. Knowlton.

Paratypes, Montana. 4 ♀, Beaverhead Co., July 1 and 10, 1936; 5 ♀, Dillon, Beaverhead Co., June 30, July 13 and 15, 1936; ♀, PSO Ranch, Dillon, Mont., all Wm. L. Jellison; ♂, Beaverhead Co., Mont., July 11, 1928.

Idaho. ♀, Parma, 7-26-30, alfalfa; ♂, Preston, July 2, 1937, G. F. Knowlton.

Washington. ♀, Yakima, June 22, 1935, C. B. Philip; ♂, ♀, Yakima, Aug. 10, 1931, A. R. Rolfe.

Oregon. ♂, Deschutes River, near Redmond, Ore., July 31, 1939; ♀, Prairie City, July 2, 1939, both by Gray and Schuh.

California. ♂, Big Pine, Inyo Co., June 19, 1929, R. L. Usinger; 3 ♀, Roosevelt, July 1, 1913, J. E. Graf; 2 ♀, Topaz, Slinkard Valley, July 31, 1919; ♀, Bishop, Inyo Co., June 21, 1929, E. P. Van Duzee; ♀, Lake, Mono Co., June 23, 1937, J. H. Mitchel.

Nevada. ♀, Winnemucca L., July 17, 1911, J. M. Aldrich.

Utah. ♂, Roosevelt, 6-29-37, F. C. Harmiston; ♂, Toole, 8-21-37, Golden Rod by L. L. Hansen; ♂, Huntsville, 6-27-37, Knowlton; ♀, Willard, July 21, 1939, G. F. Knowlton; ♀, Logan, July 3, 1935, Smith and Gunnell; ♀, Greenville Can., June 30, 1935, H. C. Armstrong, on horses; 3 ♀, Logan Dry Can.; 1, July 10, 1933, Knowlton; ♀, Province, 7-2-35, C. F. Smith, on horse; ♀, Logan, July 30, 1938, Knowlton and Hardy, at light; ♀, Hooper, 7-28-36, Knowlton, at light; ♀, Sardine Canyon, Aug. 3, 1935, C. F. Smith; ♀, Smithfield, 7-7-37, Smith and Harmiston; ♀, Logan, June 21, 1925; 2 ♀, "Em. Can., E17000, Hall-62525"; ♀, Logan, June 8, 1931, Wylie Thomas; ♀, Ogden, Meadow Swamps, 6-21-38, Knowlton and Harmiston; ♀, Perry, June 26, 1940, Knowlton; ♀, Magton, 9-3-39, Knowlton and Zirker.

Colorado. ♂, Boulder, June, 1923, R. Shotwell; ♂, Monte Vista, July 2, 1933, K. Machler; ♀, Glenderey, Aug. 1931; 6 ♀, Ft. Collins, 6-28-07, 7-1 and 18-31, 8-28-31 and 7-12-09 (2); 3 ♀, Boulder, VI-22 and 27, 1931, July 1, 1937, M. T. James; ♀, Boulder, July 5, 1937, Cockerell; ♀, Ft. Collins, 8-4-35, at light; 2 ♀, Ft. Collins, 6-28 and 7-17, 1931; ♀, Boulder, VI-27-1922; ♀, Ft. Collins, June 28, 1900; ♀, Boulder, 6-28-31, R. H. Beamer; 2 ♀, Grd. Junction, 6-27 and 7-6-1932, L. G. Davis; 2 ♀, Canon City, 8-1-31; ♀, White Rocks, July 6, Cockerell.

South Dakota. ♀, Hot Springs, June 9, 1924, "H".

In the Collections of the British Museum (N. H.), U. S. and Canadian National Museums, Museum of Comparative Zoology, California Academy of Sciences, Ohio State Museum, Universities of Kansas and Colorado, Colorado and Utah State Colleges, The Rocky Mountain Laboratory, L. L. Pechuman, T. H. G. Aitken, G. B. Fairchild and the author.

The species has been determined by authors and described by Hine (1904), Rowe and Knowlton (1935), and Stone (1938, Fig. 18A) as *T. intensivus* Townsend. But the latter, as shown above, is actually *T. dorsifer* Walk. Variations of increasing melanization both in color pattern and vestiture occur, in which the hairs on the second palpal segments, legs particularly the hind-tibial fringe, dorsum of the thorax and abdomen, and a mid-ventral band become predominantly black; the pale maculations of the abdomen are correspondingly reduced, even to isolated pale spots quite unlike the typical form in appearance. These forms were included by Stone (1938) under *T. gilanus*. The latter species is more southern in distribution, New Mexico and Arizona, and there is greater tendency for denudation of the subcallus, and less general pollinosity of the body.

These dark northern specimens are so different in appearance that for taxonomic and key purposes, they are here given a subspecies name, though as in certain other species, intergradation precludes sharp lines of demarkation. It is a pleasure to name this form for the collector, Dr. Wm. L. Jellison who has provided the author with much valuable material.

***Tabanus stonei jellisoni* n. subsp.**

Holotype ♀, 14.5 mm. Differs from typical *stonei* in extensive melanization, including a large, subshiny, dark spot almost the width of the vertex, the thoracic lines almost obscured by black hairs on the dorsum, the pale maculations on the abdomen reduced to small isolated spots sublaterally while the mesal triangles have almost disappeared, the hind-tibial fringe entirely black, and black hairs scattered on the cheeks, palpi, legs and a midventral band.

Norris Basin, Yellowstone Park, Wyo., July 2, 1934, Wm. L. Jellison.

Paratypes, 2 ♀, same data as holotype; ♀, Madison Junction, July 1, 1934, and 3 ♀, Old Faithful, July 2, 1934, Yellowstone Park, Wyo., Wm. L. Jellison. In some of these the abdominal pattern is more extensive but still predominantly dark. In the collections of the U. S. National Museum, W. L. Jellison, and the author.

There is so much variation in the characters of the front, abdominal pattern, and vestiture in series of *stonei* that the only satisfactory, constant difference for separation from *gilanus* Towns. (not authors) is the more elongate shape of the basal section of the third antennal segment of the former; the ratio of width to length (excluding the annuli) in eight specimens of *stonei* did not exceed 3:5 and averaged nearer 5:9, of *gilanus* 3:4 and 6:7, respectively. Those of all *gilanus* are rather sharply bicolored, bright red basad of the middle and including the first two segments, while most *stonei* grade gradually into brown basally, the first two segments being dark pollinose.

The subcallus is often naturally denuded, and the hind-tibial fringe of hairs usually (not always) black in *gilanus*, seldom so in *stonei*. No males of *gilanus* were available for comparison. From *laticeps* Hine of the Pacific Coast, females are even more difficult to separate; *laticeps* is, in general, more reddish over the sides and antennae basally. I have seen none of the last with other than black hind-tibial fringes in either sex. The males are more readily separated; the heads are more rounded across the eyes in *laticeps*, and the palpi less swollen and more attenuated apically in the specimens studied. Occasional variations are likely to be encountered which will be difficult to assign specifically without adequate series.

Dr. Alan Stone, for whom the species is cordially named, indicated to the writer the need for its separation from the more restricted and southern *gilanus* as reidentified.

T. leucomelas Walker. The type was badly greased and, after cleaning, redescribed by Mr. Oldroyd, still without enabling the writer to recognize this southern species. The finely hirsute eyes and the lack of the ocelligerous tubercle would possibly relate it to the western *gilanus* group. For further reference, his redescription is here included:

"*T. leucomelas* Walker. Fine short hairs are certainly present in the eyes of this type, though I fancy for the purposes of a key it would be regarded as bare-eyed. It seems to run down to couplet 17 in Stone's key, and differs from the description of *euryceras* Philip in the grey prescutal lobe and venter, and in the rather longer annular portion of the third antennal segment. Here is a redescription of it:— ♀, *Head*: grey, with whitish tomentum, and white hairs. *Frons* about three times as long as wide at base, parallel-sided. *Vertex* bare, shining reddish brown, without ocellar tubercle; basal callus large, quadrate, median callus broadly elliptical, narrowly joined to basal; both are reddish brown. *Antennae* greyish orange, except basal half of basal portion of third antennal segment, which is bright orange. *Palpi* white, not very strongly widened at base. *Thorax*: black dorsally, with mainly black hairs, laterally and on pleura dark grey with white hairs; no distinct reddish areas. *Scutellum* black with pale hairs. *Abdomen*: blackish, with red lateral patches near base, pale segmentations, and three rows of grey spots. The median rows are triangular, long, concave-sided, and reach fore-margins of segments; lateral spots large, reaching fore-margins of segments, except on second segment, where the sides are broadly orange. *Venter* grey, a little yellowish in middle. *Hairs* black on dark areas above, pale otherwise. *Legs*: Femora grey; tibiae yellowish brown, darkened towards tip, especially fore-pair. *Tarsi* dark reddish brown, hind pairs reddish. *Wings*: hyaline, without fuscous spots; costal cell hyaline. *Length of body* 13 mm.; *of wing* 12 mm. 1 ♀ U. S. A., Georgia, ex coll. Abbott."

Tabanus sequax Will. Allotype ♂. Length 15.5 mm. Essentially like the female, except for the usual sex differences, and easily associated. Head rather flattened, broad, the size of eye facets only slightly enlarged above and densely hirsute all over; eyes with a single narrow stripe and the lower border purple. Vertical triangle entirely pollinose and pilose, not raised above eye level. Frontal triangle but little swollen, grayish pollinose, blackish in the apex. *Antennae* black, reddish tinges at the extreme base of the third segment, of the same shape as in the female but narrower. *Palpi* smoky to dark reddish on the apical joint; the latter ovoid, about twice as long as thick, with black and pale pile intermixed; pile on basal joint pale. *Wings* with clouded cross-veins as in ♀. Outer fore tarsal claw much elongated. Gird Point, 7775 feet, Ravalli County, Montana, Aug. 23, 1939, 7:45 A.M., C. B. Philip. Another specimen, essentially similar, was taken two weeks earlier in the same place by Mr. Herbert Wilkerson. The frayed wing margins indicate its presence

on the wing for some time, but the specimen is otherwise in excellent condition of pilosity and color.

T. fuscipalpis Bigot, a synonym, is often misspelled *fuscipalpus*.

The generic position of *sequax* is enigmatic because of the densely hairy eyes and flattened heads in both sexes, without ocelligerous tubercles. Structural separation of the *gilanus* group from *Tabanus* would be complicated by this unrelated species. In some respects it resembles certain European species of *Therioplectes*. In the Nearctic fauna, it is retained provisionally in *Tabanus* s. lat. for want of more satisfactory assignment at present.

Hybomitra aatos n. sp.

A grayish, medium-sized (14 to 16.5 mm.) species intermediate between *atrobasis* of the red-sided group and *tetricus* of the species with three rows of abdominal triangles.

Holotype ♀, length 16.5 mm. Eyes hirsute, (relaxed) with the usual three stripes and lower border purple. Front buff pollinose, darker on the vertex and around the medium callus, height about four times its basal width, slightly convergent below; the callosity relatively large, convex, piceous, subquadrate, the upper corners rounded, separated narrowly from eye margins only above, and widely from the subovate, blackish, median callus; no bare ocellar tubercle, but a wide, dark pollinose prominence on the vertex, V-shaped in front. Subcallus gray pollinose, the median line widening above into a small, bare, inverted triangle continuous with the callosity. Antennae with the first two segments and extreme base of the third reddish, black distad of the dorso-basal prominence which is low, obtusely angulate, situated at about the basal fourth; excision very gentle, the apical annulus markedly attenuated. Face whitish pollinose and pilose, a few black hairs intermixed on the fore cheeks. First palpal segment yellow, with whitish hairs; second segment robust throughout, but not particularly swollen basally, blunt apically, deep yellowish, with appressed black and a few white hairs.

Thorax dark with the usual grayish lines, scutellum concolorous, the pre-scutal lobes black. Pleurae gray with whitish pile predominating, but some black. Wings hyaline, costal cells faintly tinted, small clouds at the fork of vein R_4 , no spurs. Fore and hind (except knees) and basal third of middle femora black, remainder of legs deep reddish, darkening distally, particularly on fore pair; inner surface of middle femora whitish hirsute except for few black hairs at knee; hind-tibial fringe black.

Abdomen blackish dorsally, with a median row of pale triangles reaching little more than half across their respective tergites (2 to 5), and two rows of practically contiguous, sublateral, flesh-pink dashes on the second to fourth tergites, all accentuated by white hairs, the black geminate and lateral maculations overlain with black hairs, the sides of the second tergite with reduced, crescentic, black integumental spots; first tergite entirely dark gray, with a narrow, reddish hind margin as in *atrobasis*. Venter predominantly reddish, with short white hairs, a few black on the fifth and sixth sternites.

Ten miles south of Laramie, Wyoming; June, 1938, C. B. Philip, "about car".

Allotype ♂, 13 mm. Like the female except the usual sexual differences. Eyes densely pale hirsute, subcallus gray pollinose, vestiture of base and palpi predominantly whitish, first antennal segment red, palpi moderately swollen, pale yellowish, apically with a slight point. Posterior surfaces of middle femora with considerable pale hair. Costal cells and "fork" of wings faintly tinted; no spurs. Acuminate apex of middorsal pollinose triangle on second tergite reaching about three-fourths across segment.

Manitou, Colo., June 19, 1926.

Paratypes. Colorado, ♀, Jim Creek near Boulder, June 21-23, 1923, about 6400', 8 ♀, El Paso Co., June 14, 20, 28, and July 2, 1914 (two by A. B. Champlain); 2 ♀, El Paso Co., Mt. Manitou, 9000', July 1, 1921, Grace O. Wiley; 3 ♀, El Paso Co., June 18-25, 1937, W. Benedict; 7 ♀, Mesa Verda, July 3, 1937, R. H. Beamer, and C. L. Johnston; ♀, Ft. Lewis, June 8, 1930, "No. 4902"; ♀, Horsetail Mt., June 8, 1936; 3 ♀, "Collection C. N. Riley"; 2 ♀, Pagosa Sprgs., June 21-23, 1919, "F4361," 7500'; ♀, Minnehaha, June 16, 1918, "Rubus deliciosus"; ♀, Granite Peaks, Camp 9000', Bayfield, July, 1928, J. Bequaert; ♀, Boulder, June 18, 1933, M. T. James; 2 ♀, Cripple Creek, 8930'; ♀, Jamestown, "62505" "Oct. Sub. Lot 2"; 2 ♀, "So. Colo.", Morrison; 2 ♀, Jamestown; 2 ♀, Cripple Creek Rd., 8930', July; 10 ♀, Manitou, June 30, 1928, J. Bequaert; 6 ♀, Paonia, Delta Co., June 15; ♀, Mt. Manitou, June 24, and 14 ♀, Manitou, June 19, 20, 23, 24, all 1926, E. C. Van Dyke.

New Mexico. ♀, Chama, July 5, 1937, R. H. Beamer; 3 ♀, Torrance Co., June 11, 1931, J. G. Shaw; ♀, Kochler, June 20, 1914, D. J. Caffrey; ♂, ♀, Jemez Sprgs., July 2, 1929, G. P. Englehardt; 4 ♀, Tajique, June 25, 1940, R. H. Beamer.

In the collections of the Berlin Zoological Museum, British Museum (N. H.), Museum of Comparative Zoology, the U. S. National Museum, California Academy of Sciences, Universities of Kansas and Colorado, Colorado State College, The Rocky Mountain Laboratory, L. L. Pechuman, G. B. Fairchild, and the author.

Variations are found in the extent of infuscation of the middle femora, but no paratype shows predominance of black distal hairs seen on the inner face of this joint in *atrobasis* of which all examined, including two paratypes (one topotypic), have all but the immediate knees black, as well as distal patches of black hairs on the inner surfaces. The extent of black on the abdomen of *aatos* also varies, the lateral black integumental spots reduced or absent on tergite 2 and reduced on tergite 3, while in dark specimens there is a definite though pale yellowing of the costal cell of the wing. One paratype is without the lateral pinkish ground color, resembling some *tetricus* var. *hirtulus* superficially; the lack of wing spurs and black prescutal lobes easily distinguish *aatos*, however. Despite the almost identical shapes and colors of antennae and palpi, and similarity in color of prescutal lobes and first abdominal tergites, *aatos* females are readily separated from *atrobasis* by the larger frontal callosities (disconnected from the median callosities in specimens studied), duller abdominal pattern with three rows of triangles usually underlain laterally by pinkish (red on sides of *atrobasis* is extensive, deeper, and not interrupted by black spots on the sides of the third and often second tergites), and the predominantly whitish-haired inner faces of the second femora frequently combined with extensive reddening of the ground color distally. The male differs from that of *atrobasis* in the predominantly pale vestiture of palpi, eyes, and face, red rather than black first antennal segments, and brighter reddish sides of the abdomen overlain by pale dashes. The mid-femoral vestiture is also pale behind as in the females. The second palpal joints are paler and less swollen than in either *atrobasis* or *rupestris*. The palpi of the male paratype are a little more swollen, and there is no evidence of an apical point.

Hybomitra comes (Walk.). There is some confusion about the types of *inscitus* for which *comes* is a change of name. Two localities were given but the description is of headless specimen(s). Osten Sacken (1876, p. 473) found five specimens of three species under the name in the British Museum eleven years after publication of Walker's description. Additional comments by Oldroyd may be quoted *in toto*. "There are two specimens in the B. M. standing

under *comes* Walker, each with a small label of Walker's time "N. Scotia", and with recent labels by Ricardo 'Paratype', and 'ex. col. Lieut. Redman'; both specimens have heads. There is nothing to show whether Walker's 'head wanting' applies to both his specimens, or only to the first, but he implies that there was only one from Redman's collection. With these reservations I have compared your specimens, (*T. astutus*, O. S., *T. typhus* Whit., *T. liorhinus* Philip, *T. fairchildi* Stone) with the 'para-types'.

"Superficially more like *fairchildi* than the others, but *fairchildi* is at once distinguished by the narrower frons. Frons of *comes* is like that of the other three species, about $3\frac{1}{2}$ to 4 times as long as wide, and nearly parallel-sided. *Comes* is nearest *astutus*, but differs in larger size (14 mm.), and in mesonotum more pollinose, and with more distinct grey stripes. The prescutal lobes are black. Abdominal spots well-defined and rounded inwardly, with a little reddish color at sides of second segment. Wing-markings like those of other species of this group—costal cell hyaline, but a brown stigmal spot at tip of R_1 . The pilosity of the eyes is denser. I am not convinced that this is synonymous with *astutus*, though it is very near, and it is certainly not one of the others."

The name can remain at best questionably related to *T. astutus* as previously discussed by the writer (1936, p. 156).

Hybomitra gracilipalpis (Hine). Study and comparison of the allotype female of *H. cristatus* (Curran) confirmed the writer's (1937) and Stone's (1938) opinions of its agreement with *gracilipalpis*. As stated previously, however, there is no certainty of correct association of the sexes in view of the difference in localities (Alta., ♂; Labr., ♀). Synonymy is therefore left with doubt until females from Nordegg, Alta., and the undoubted males of *gracilipalpis* are available to clarify the problem. A male from Eagle, Alaska, is in close agreement with a paratype of *cristatus*, indicating at least coincidental distribution.

Hybomitra melanorhinus (Bigot). Two males and a female taken by Mr. Herbert Wilkerson and the writer on Gird Point Lookout at the same time as the male of *osburni*, described below, confirm the constancy of the bare frontal triangle observed previously by Stone (1938) and the writer (1937), thus eliminating any question of specificity with *opacus* (Coq.) raised by Stone. These are darker like the females and in one with only a suggestion of reddish on the prescutal lobes, thus approaching *osburni*. In males of the latter with considerable red on the abdomen, this color still does not invade the venter. Other differences, in addition to the red prescutal lobes of *melanorhinus*, are the smaller vertical tubercles, the shorter antennal scapes (which are blackish in these two specimens), and plates with dorsal angles a little more pronounced. A peculiarity common to both species is a gray pollinose patch in the extended apex of the frontal triangle.

Hybomitra rhombicus subsp. *osburni* (Hine). Hine (1904) describes the male of *osburni* as, "12 mm. Like the female except the grayish spots appear to be lacking on the dorsum of the abdomen", in addition to sexual differences. As this does not eliminate the later described male of *T. laniferus* McDun., and as questions of synonymy of *osburni* and *rupestris* McDun. with *rhombicus* have been raised (Stone, 1938), the male is here redescribed from a specimen taken on Gird Point Lookout, 7775 feet, August 23, 1939, (7:45 a.m.), near Hamilton, Montana, by the writer. Length 13 mm. Eyes with three stripes and the lower border purple, area of enlarged facets but slightly differentiated, densely brown pilose. Vertical tubercle raised, not denuded anteriorly as usual in *Hybomitra*. Frontal triangle entirely shining black, convex. Antennae narrow, not excavated, black, the basal third of the plate bright reddish. Apical

palpal segments very swollen, length less than twice the thickness, blunt apically, deep yellow and covered with black pile. Cheeks unusually swollen on either side of the bases of the antennae, predominantly black haired. Dorsum of thorax and prescutal lobes black, the usual gray lines reduced, with sparse yellow appressed hairs. Fore-tarsal claws rather long, the outer one a little the longest. Abdomen black, densely covered with black hairs, pale ones rather narrowly across the ventral and discontinuous on the dorsal incisures, those on tergite 2 running inwardly to form small diagonal patches sublaterally; small middorsal patches on the hind margins of tergites 1 to 4. The second tergite with the integument, beneath the black hairs sublaterally, obscure brownish.

The denuded frontal triangle (not rubbed) quickly distinguishes this from related species excepting the more red-sided *melanorhinus*, and indicates the specific validity of *rupestris* with its pollinose subcallus in the male.

Hybomitra septentrionalis (Loew). Study of a long series of specimens from Colorado to Alaska, and a good many males, not only convinces one that this is undoubtedly composite as now considered, but unfortunately, that such variation and intergradation occurs that it is impossible to find a consistent line of cleavage, including the red sided form *frontalis* Walker which Stone has recognized specifically. I have tried tabulating individual characters, geographically, morphologically, and tinctorially without successful separation. There is a dark form in British Columbia and Alaska with eye bands subequal and a lower border characteristic of the *affinis* group which is probably distinct from the typical form with three narrow purple bands on a green ground. It appears impossible that two specimens from Wyoming could be the same species, one 9.5 mm. and entirely grayish black with normal wing venation, the other, 16 mm., with short wing spurs, and the abdomen reddish except for the rows of dark dashes, but completely intergrading specimens are found, at least in neighboring states. Description of species based on one or a few specimens will only confuse, rather than clarify, the difficult taxonomy of this species complex. If *labradorensis* End. is to be separated on the basis of the short wing spurs, as Stone (1938) implies, then a good many western specimens, otherwise variable, are also distinct. This procedure seems inadvisable at present, and the writer still feels, as previously (1931), that *labradorensis* is a part of this complex, with which it was originally compared by its author. As also indicated previously (Philip, 1937), some of the darker males, apparently of *frontalis*, approach those of *sonomensis* in areas where they occur together. Others, particularly those with a pollinose bloom over the body and the margins of the middorsal black band of the abdomen irregular, are unquestionably *frontalis*; most of these have the reddish sides more extensive than in most females and the median triangles more obscured. Males of typical *septentrionalis* have not been seen but also are likely to have more extensive reddish laterally than the females, judging from similar conditions in such species as *melanorhinus* and *rhombicus*.

The forms with confluent reddish sides may be provisionally assigned to *frontalis* as a subspecies for systematic convenience, pending clarification of the complex, but intergradation precludes sharp definition as it does also in the related *sonomensis-phaeonops* complex.

Hybomitra tetricus (Marten). On the basis of my previously stated opinions that this and *hirtulus* Bigot are conspecific, I have decided to use the prior name in spite of the fact that *tetricus* represents the less common variant with denuded subcallus, a variable character in this species. Intergrades also occur with the following subspecies, especially in the males, but the typical extreme in the southern part of its range looks more like one of the *affinis* or red-sided group than it does like *tetricus*.

Hybomitra tetricus subsp. *rubrilatus* Philip. Through kindness of Dr. K. Delkeskamp of the Berlin Museum, the type of *Tylostypia laticornis* End.,

1925, was forwarded for study, and it proves to be this red-sided form of *tetricus*, which relationship was suggested by the writer in 1937 but questioned because of the misleading, original comparison with "*Tylostypia*" *lasiophthalmus* (Macq.). Since the spur-vein of the wings of *tetricus* is hardly of generic significance in this group of flies, Enderlein's name is preoccupied by *Hybomitra laticornis* Hine, 1904, which also has hairy eyes and a small, but definite, ocelligerous tubercle.

Hybomitra (?) *vicinus* Macquaert. This is apparently a *Hybomitra* of the red-sided group, and Osten Sacken (1876) suggested its relationship to his *T. socius* (*epistates*) and placed it (1878) in *Therioptectes*. The description of *vicinus* is incomplete, with no mention of the wings, allowing only questionable comparison with *lasiophthalmus* (Macquart's next described species based on a specimen in a different collection) but which it otherwise suggests. His comparison with the European *T. luridus* (presumably Fallen) suggests a denuded subcallus, but no mention is made of such a character. Species of this genus are uncommon in Carolina, and the midventral black band apparently precludes association with *lasiophthalmus*, *carolinensis* (which Macquaert himself described), and *cinctus*. There are no familiar species in Brimley's (1938) long North Carolina list with which *vicinus* can be identified, and the name will have to remain in doubt.

Tabanus zygotus Philip. Since describing this species (1937), I have received three other females from Swim and Hood River Meadows, Oregon, July 12 and 21, 1938, Gray and Shuh (through courtesy of the latter), in excellent condition allowing additional descriptive remarks. As predicted, the prescutal lobes vary from reddish on the disc as in the holotype to completely black as in the allotype. The first two antennal segments are black in all three but the red is a little more extensive on the third in one, and in another the third segment is broader and with almost no excision, while the palpi are a little more slender over the apical half. Frontal callosities are typical in two, and subtriangulate in the third due to increased encroachment of the frontal pollinosity on either side above. The first palpal segments in all three are blackish gray and with a few black hairs. Costal cells are more definitely tinted with yellow than in the types. Owing to typographical omission in the original, the legs and abdomen are redescribed; femora, except knees, apical half of fore tibiae, tarsi, and most of vestiture including the hind-tibial fringe, black, the remainder dark red. Abdomen rather broadly deep red on sides of first three tergites, and with slight extension onto the fourth; first and anterior margin of second sternites, and fifth on, black, the remainder reddish with pallid hairs, some blackish shades anteriorly on the second, especially mesally in one specimen. Middorsal grayish triangle plain in all on the second tergite. All 14 mm. in length.

Four additional topotypic females have turned up in the California Academy of Sciences which come within the variation discussed above.

The variation from the holotype, in tinted costal cells and black prescutal lobes, precludes diagnosis in the key provided for "red-sided" females.

The females would run in Stone's (1938) key as follows:

- couplet 107. Median black stripe of abdomen narrow, constricted on 3rd tergite, red encroaching broadly on 4th.....*trepidus* McD.
 Median black stripe rather broad, lateral margins subparallel; only reduced shades of red on 4th tergite.....107a
 107a Third antennal segment markedly excavated and predominantly reddish, the dorsal tooth sharp; callosity small, flat.....*gracilipalpis* Hine.
 Third antennal segment little excavated, predominantly blackish, the dorsal angle obtuse; callosity rather large, convex.....*zygotus* Philip.

SUMMARY

The following new species of *Tabanus* s. lat. are described: *T. abditus* (♀) from Arizona, *T. stonci* (♀, ♂) and subspecies *jellisoni* (♀) from western United States, *T. oldroydi* (♀, ♂) from Guayamas, Mexico, and also *Hybomitra aatos* (♀, ♂) from the Southwest. The male of *T. sequax* Will. is described for the first time, and additional information on males of *H. melanorhinus* (Bigot) and *H. rhombicus* subsp. *osburni* (Hine) is provided. *Tylostypia laticornis* Endl. (not Hine) is synonymized with *H. tetricus* subsp. *rubrilatus* (Phil.).

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MAYFLIES OF TWO TROPICAL GENERA, *LACHLANIA* AND *CAMPSURUS*, FROM CANADA WITH DESCRIPTIONS.

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Two interesting mayflies, one a *Lachlania* and the other a *Campsurus* have been sent recently to the author, the former from Saskatchewan and the latter from Manitoba. Both are apparently new species and are described in this paper.

The *Lachlania*, represented by a single female individual in alcohol, was collected by J. E. Moore and J. S. Thompson in connection with a survey of the fauna of several saline lakes in the aspen poplar parkland country of Saskatchewan. The specimen was taken floating on the surface of the water of Stoney Lake near Humboldt. Mr. Moore has kindly supplied the following information about the lake. It has an area of one and one-half square miles and a maximum depth of five and one-half metres and has one intermittent stream as inlet and no outlet. The maximum temperature of the water which has been recorded is 21.2°C. at the surface in midsummer. The water has a pH of 8.7 and is quite saline with 8,500 parts per million of solid content in September in which magnesium and sulphate are the predominant ions. The altitude is approximately 1850 feet above sea level.

The genus *Lachlania* is neotropical, with three species described as follows, *L. lucida* Etn. from Guatemala, *L. abnormis* Hag. from Cuba, and *L. pallipes* Etn. from Ecuador. While no *Lachlania* have been taken north of these localities, *Oligoneuria ammophila* Spieth, a member of the family Oligoneuridae to which *Lachlania* belongs, has been described from the nymphs taken in the White River at Decker, Indiana (Spieth 1938). This nymph is quite unlike the nymph of a *Lachlania* species described by Needham and Murphy, 1924.

***Lachlania saskatchewanensis* n. sp.**

Female imago (in alcohol). Length 7.5 mm., wings 10 mm., caudal filaments 5 mm. (fig. 1.).

Head pale brown above with darker infuscation about the ocelli and a dark brown band extending in a curve between the lateral ocelli. On the vertex another dark brown patch in the form of a V. Antennae with dark brown ring on the second segment, and the flagellum dark brown. Frons extended as a hood over the mouth parts.

Thorax. Pronotum dark umber brown with narrow pale median line, some pale colour on lateral flanges. Mesonotum dark umber brown with pale areas across anterior border and at bases of wings. In addition a roughly H-shaped pale marking on dorsum as in figure, this pale area being continuous posteriorly with pale lines which run out on the border of a peculiar flange

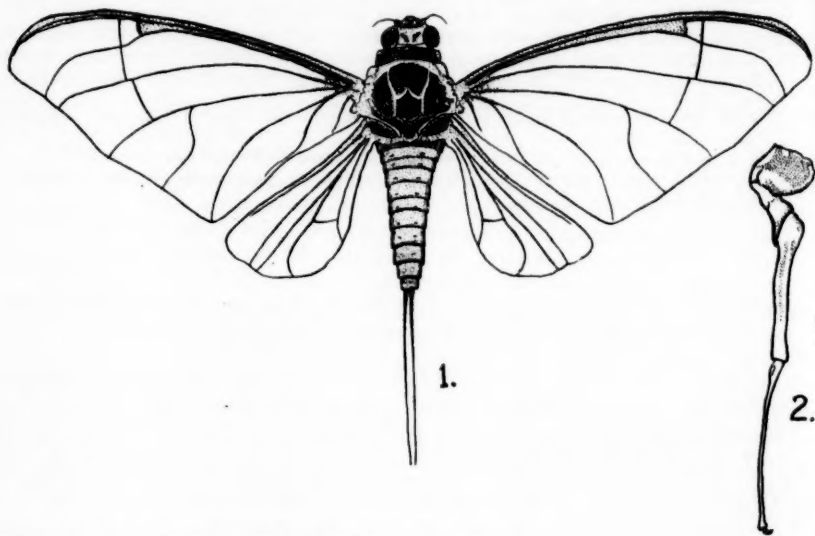


Fig. 1. Female imago of *Lachlania saskatchewanensis* n. sp.

Fig. 2. Left metathoracic leg of *L. saskatchewanensis* n. sp.

developed laterally on the mesonotum. Metanotum piceous, somewhat paler than the mesonotum.

Abdomen piceous, the overlapping of the segments appearing as darker brown transverse bands. On the anterior segments, lateral paramedial darker brown strokes nearer the posterior than anterior margin of the segment. In the posterior segments which are somewhat darker than the anterior, these dark brown strokes are replaced by pale dots. There is a very faint indication on some segments of a median pale line.

Caudal filaments (2) dark brown basally, with a pale patch on the medial surface. Distally the segments separated by pale rings with a gradual dilution of the intensity of the brown colour towards the tip.

Ventrally the abdomen is somewhat paler in colour than dorsally. On the anterior segment there is a very distinct paramedial dark brown stroke posteriorly and a more extensive sinuate dark line anteriorly. The venter of segment seven is produced posteriorly and has an excavated border. On this segment are vestiges of the nymphal gills in the form of minute curved appendages.

Legs pale amber with brown infuscation on femora and with coxae dark brown. All legs similar, twisted and atrophied distally and probably non-functional (fig. 2).

Wings. Venation as in figure. In alcohol the membrane is translucent whitish with no evidence of the bluish reflection which is mentioned in the descriptions of other species in the dried condition.

Holotype, ♀, Stoney Lake, near Humbolt, Saskatchewan. September 5, 1940, J. E. Moore and J. S. Thompson. In the collection of the Royal Ontario Museum of Zoology, Toronto.

This species is apparently close to *L. abnormis*, agreeing in size with this species and being smaller than the other species described. The description of *L. abnormis* by Eaton, 1888, is rather inadequate, but special features of the colour pattern which are striking in this new species are not mentioned in the description, and it is not probable that they would have escaped the notice of Hagen in his original description. The greater curvature distally of the longitudinal veins in this species provides another basis of separation.

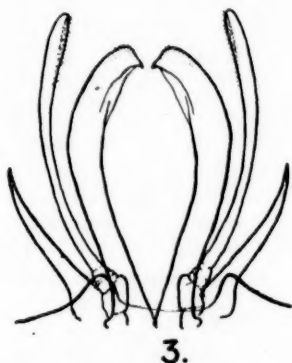


Fig. 3. Male genitalia of *Campsurus manitobensis* n. sp.

The *Campsurus*, represented by seven male imagoes, was collected by Dr. W. E. Ricker at Cartier, Manitoba, on the Assiniboine River. The genus *Campsurus* has twenty-seven described species and is confined to the new world. Five of these have been recorded from the United States and the remainder are neotropical. One species, *C. primus* McD., was taken at Grand Tower, Illinois (McDunnough 1924). The present species is apparently new and is the most northerly record for this genus to date.

***Campsurus manitobensis* n. sp.**

Male imago (dried). Length 11 mm., wing 12 mm., caudal filaments 31 mm.

Head. Eyes dark purplish brown, vertex and basal segment of antenna paler piceous; remainder pale yellowish.

Thorax. Prothorax hyaline yellowish; meso- and metathorax pale brownish yellow.

Abdomen pale yellowish, somewhat more opaque yellowish in oblique blotches below the pleural fold. Caudal filaments whitish.

Legs. Forelegs with pale yellowish coxae and femora, tibia faintly stained and tarsi somewhat more deeply stained with purplish brown. Meso- and metathoracic legs pale yellowish, less than half the length of the forelegs and atrophied. These legs are, however, less reduced than in *Campsurus segnis* Needham as described by Morgan, 1929.

The genitalia as in figure 3.

This species is close to *C. incertus* Traver from which it may be distinguished by the lack of dark marking on the abdomen and the lack of the greyish colour of the costal region of the forewings, both of which are characteristic of *C. incertus*. The tubercle distally on the medial surface of the penes of this species is lacking in *C. incertus*.

C. puella Pictet, from the incomplete description, apparently has dark marks on the abdomen which are lacking in this species.

Holotype, ♂, Assiniboine River, Cartier, Manitoba, August 2, 1935, W. E. Ricker. Royal Ontario Museum of Zoology, Toronto.

Paratypes, 5 ♂, same data; 4 in the Royal Ontario Museum of Zoology, Toronto; 1 in the Canadian National Collection, Division of Entomology, Ottawa.

Both of these species belong to southern groups and belong to genera which are confined to the New World. Most of the *Campsurus* species are South and Central American, the number diminishing northward through the United States. The species described in this paper ranges furthest north of the known species as far as the records go. *Lachlania* would seem to have a more discontinuous distribution than *Campsurus*, species persisting in South and Central America, in Cuba, and in this northern outpost. While no records of its occurrence in the United States have been made, it is possible that, with more collecting in the midwest, species of this genus will be found bridging this apparent gap in geographical distribution. If this does not prove to be the case, this northern species must be regarded as a relict of a time when the genus was more continuously spread over North America. The factors which favour its survival in its present habitat in Saskatchewan may possibly be a combination of climatic conditions and the saline water in which it lives.

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